**Lecture: Sanitation & Creating a Stable Micro-Ecosystem Part 2**

**Date: February 4th**

**Galvanic Corrosion:**

Two metals with different electrochemical potentials placed in an electrolyte will cause corrosion of one of the metal species.

The rate of corrosion depends on:

1. Galvanic Potential
2. Electrolyte strength
3. Surface area of metals
4. Exposure time
5. The aggressiveness of the corrosion depends on the galvanic corrosion potential difference between the metal species. To determine the potentials salt water is used as an electrolyte standard and different metals are placed into the solution. The most active metal will corrode and are listed in order of most active to least active. The greater the separation on the list, the more aggressive the corrosion.

**Most Active:** Magnesium

Zinc

Aluminum

Carbon Steel/Cast Iron

Brass

Copper

S. Steel

Gold

**Least Active:** Platinum

**\*Lists are called Galvanic Series**

1. A stronger electrolyte will increase the rate of corrosion
2. At a 1:1 ratio of Active/Passive metal you will have your normal corrosion rate. Increasing the surface area ratio in favor of the passive metal will increase the rate of corrosion, and vice versa.   
     
   Example: A brass surface in contact with a small amount of aluminum will cause quick corrosion of aluminum, while a brass fitting in contact with a large amount of aluminum will decrease the rate of corrosion.
3. Galvanic corrosion takes place in the presence of an electrolyte, in this case WORT. Brewing at home and in the lab means contact time is limited to a few hours a week, commercial brewing will have much longer contact times. The quality of equipment must be taken into consideration when scaling up.

**Materials: Plastic vs. Glass**

|  |  |
| --- | --- |
| **Glass** | **Plastic** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Pros** | **Cons** | **Pros** | **Cons** |
| Chemically Inert  Resists Scratching  Provides Visuals | Fragile  Expensive  Hard to clean  Racking is difficult  Heavier | Cheap  Durable  Light | Harder to maintain  Opaque  Harbors odors (over time) |

**History Lesson**

Beer has been around for thousands of years. Ceramic jugs have been found sealed with wine, on the lids were the names for the wine and vineyard and descriptions the wine itself.

-Mesapotamia: Recorded recipes and references found on tablets

-Egyptian Ceramic Jugs: Wine descriptions

-Egyptians paid with beer: Pyramids built in 20 years = 231,400,000 gallons of beer

-Medieval Times: Church taxed barley, encouraged church attendance by offering beer

Beer itself has been the driving force for many of our everyday commodities.

-Beer as a way to make water potable

-Poor sanitation and unregulated industry destroyed rivers and streams

-Beer to Drive Technology

-Writing: Recipes -First Fridge: 1857 James Harrison

-Pasteurization: 1862 Louis Pasteur -Automation: Automated Bottling Machine: Michael Owens 1904

Automation and refrigeration were driven by the desire to produce more beer, faster, all year round. The beer industry is an innovation power house. Anyone considering entering the brewing industry should think about what this industry needs next or how they can apply existing technologies to the brewing scene.

We have been fermenting every kind of plant we could get our hands on. One kind of beer, Chicha, was/is made by designating a villager as the grain chewer. He chewed ground up corn and the enzymes found in saliva, *CARBOHYDRASES*, that break down the starches into fermentable sugars.

So why am I telling you this? Because anyone can make beer, but it takes a rigorous methodology to create and reproduce a product.

**Maslow’s Partial Hierarchy of Needs**

Physiological: Food, Air

Safety: Temperature Controlled Environment

Ales and Lagers

Love/Belonging: With 1 and 2 taken care of, Yeast can multiply and thrive/Sugars

Malting

Mashing

Wort Separation

Wort Boiling

Cooling

Aeration

Primary Ferment

Secondary Ferment

Filtration/  
Carbonation

Barley

Hops

Hops

